Catalogue of American Amphibians and Reptiles.

Ramos, Y.M. and R. Powell. 2001. *Anolis chlorocyanus*.

Anolis chlorocyanus Duméril and Bibron

Lacerta bullaris Linnaeus 1758:308 (part).
Anolis bullaris: Daudin 1802:69 (part).
Anolis chloro-cyanus Duméril and Bibron 1837:117. Type locality, "Martinique [in error] and St.-Domingue [Hispaniola]." Syntypes, Muséum National d'Histoire Naturelle, Paris (MNHM) 785 and 787, age and sex unknown (although from the description, one specimen was an adult male), date of collection and collector unknown (not examined by authors). See **Remarks**.
Dactyloa (*Xiphosaurus*) *chloro-cyana*: Fitzinger 1843:67 (Fitzinger lists "*Dactyloa bullaris* Fitz." in his synonymy, but does not provide any further details].



FIGURE 1. Subadult *Anolis c. chlorocyanus* from the Los Haitises region, Provincia de Monte Plata, República Dominicana (photograph by Richard E. Glor).

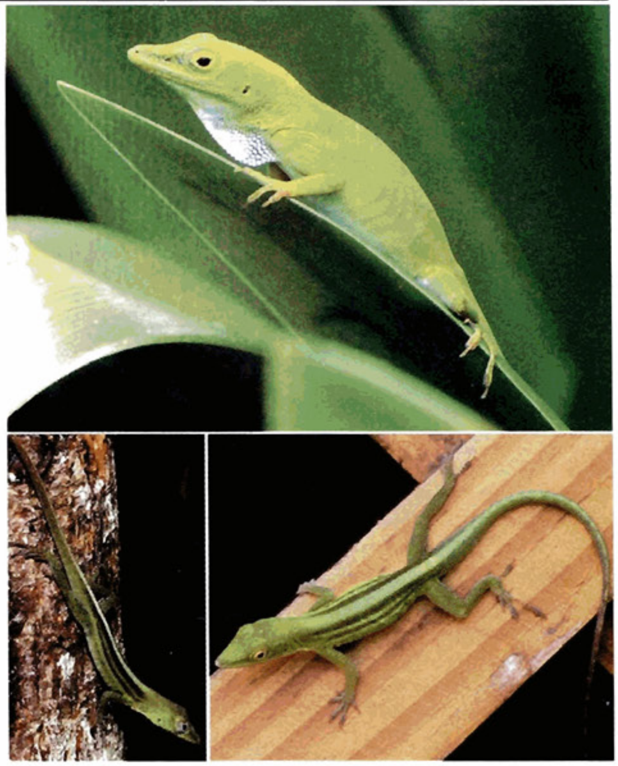


FIGURE 2. Adult female (top) and juvenile *Anolis c. chlorocyanus* (bottom right) from Casa de Campo, Provincia de La Romana, República Dominicana (photographs courtesy of John Sullivan); juvenile (bottom left) from the Los Haitises region, Provincia de Monte Plata, República Dominicana (photograph by Richard E. Glor).

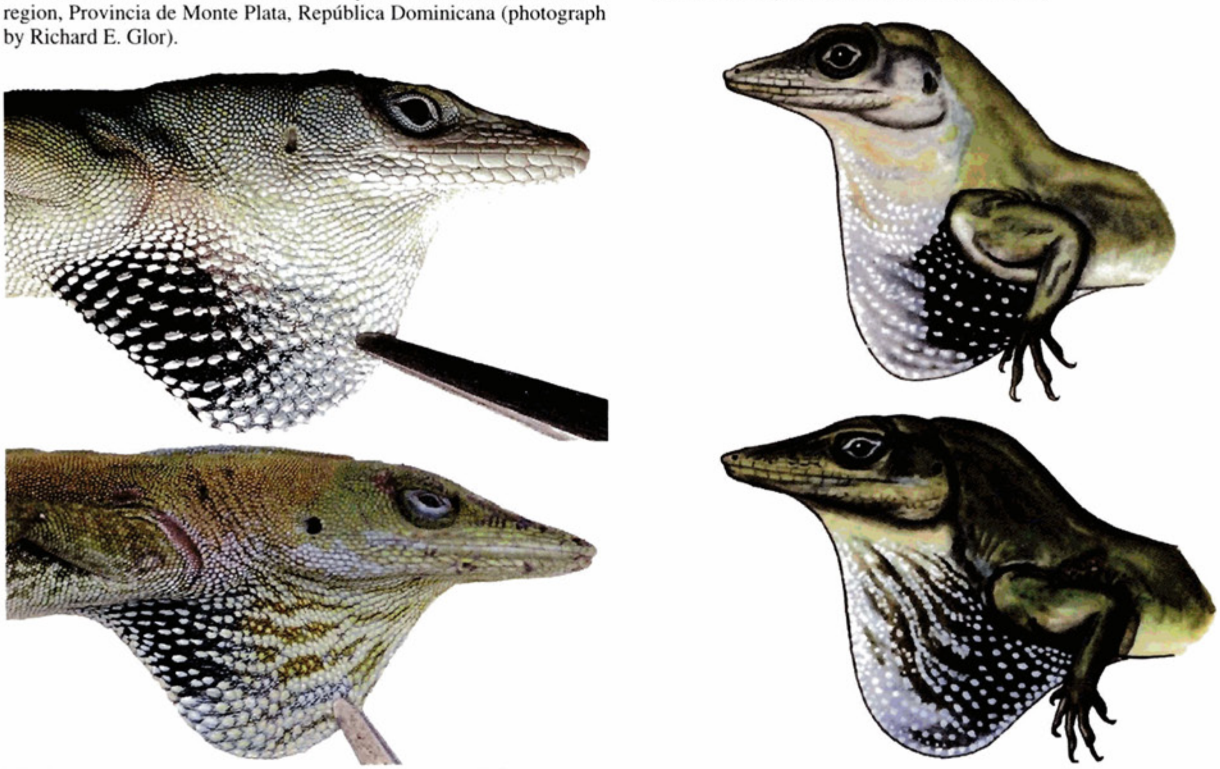
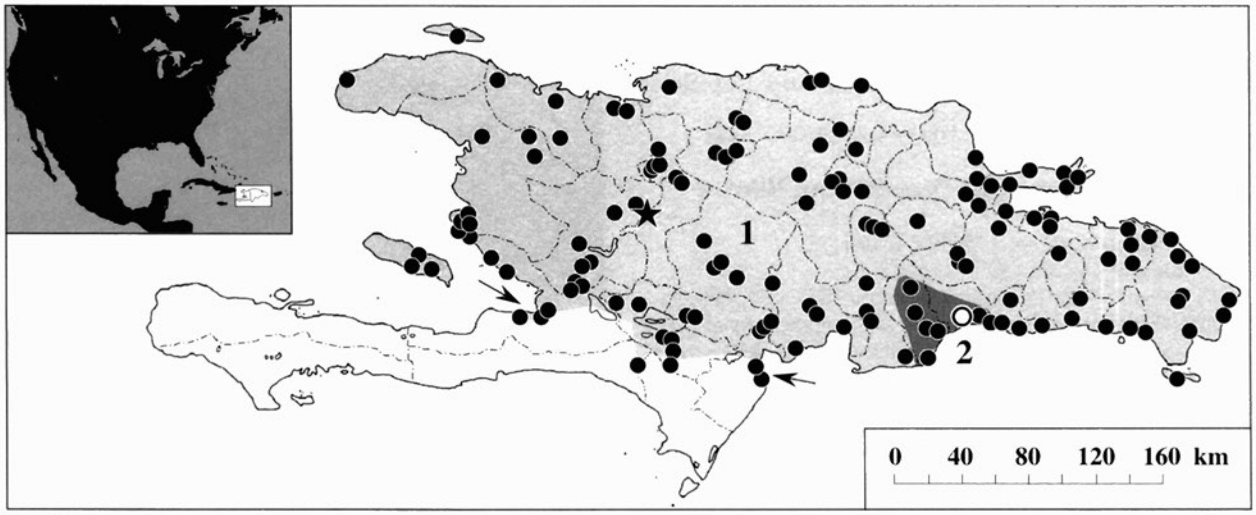


FIGURE 3. Adult male *Anolis c. chlorocyanus* (top left) from near Maizel, Provincia de Valverde, and an adult male *A. c. cyanostictus* (bottom left) from the road from Baní to El Recodo, Provincia de Peravia, República Dominicana (photographs by Richard E. Glor). Adult male *A. c. chlorocyanus* (top right) from "Haiti: l'Ouest: 7 mi. N Mirebalais (ASFS X2220)" and an adult male *A. c. cyanostictus* (bottom right) from "Rep[ública]. Dom[inicana].: San Cristóbal: 2 mi. SE San Cristóbal (ASFS X7782)" (from Schwartz and Henderson 1985).



MAP 1. Hispaniolan range of *Anolis chlorocyanus* (modified from Schwartz and Henderson 1991). The large circle marks the type locality of *A. c. cyanostictus*; the type locality of the nominate form is too imprecise to map. Dots indicate other records (many representing multiple specimens and several proximate localities), the star denotes a fossil locality, and the arrows mark sites of sympatry with *A. coelestinus* (see **Distribution**).

Anolius bullaris: Gray 1845:206 (part).
Anolis lœviceps Lichtenstein 1856:7. Type locality, unknown. Holotype, not located.
Anolis chlorocyaneus: Lichtenstein 1856:7. *Lapsus*.
Anolis chlorocyanus: Boulenger 1885:44.
Anolis chlorocianus: Olmo 1984:22. *Lapsus*.

• **CONTENT.** Two subspecies are recognized: *Anolis c. chlorocyanus* and *A. c. cyanostictus*.

• **DEFINITION.** *Anolis chlorocyanus* is a medium-sized green anole (maximum SVL in males to 76 mm, females to 53 mm). The head and body are elongated and legs are short. The head scalation (Schwartz and Henderson 1991) is characterized by 3–4 (mode 3) rows of loreals, 1–2 scales between the supraorbitals, 2–4 scales between the interparietal and supraorbital semicircles, 5 postrostrals, and 4 postmentals. The subocular scales are in contact with the supralabials. The scales behind the interparietal grade gradually into the dorsal body scales. Dorsal scales are tubercular, granular, and small, but those of the four middorsal rows are somewhat larger and slightly keeled. Ventral scales are about twice as large as dorsals, flat or slightly imbricate, and almost square. Supradigital scales are enlarged and multicarinate. The tail is fairly long, round in cross-section, with enlarged middorsal scales, and verticillate with four vertical rows of scales. Ventral caudal scales are enlarged and heavily keeled. The dewlap scales are diamond shaped, swollen apically, and larger than ventral scales.

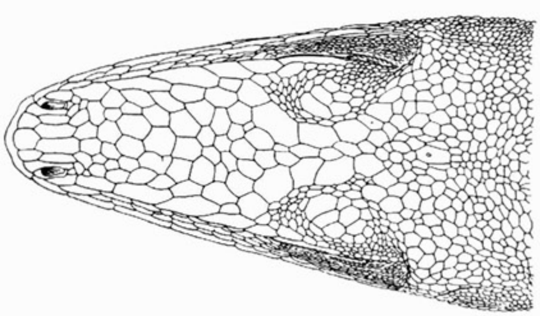
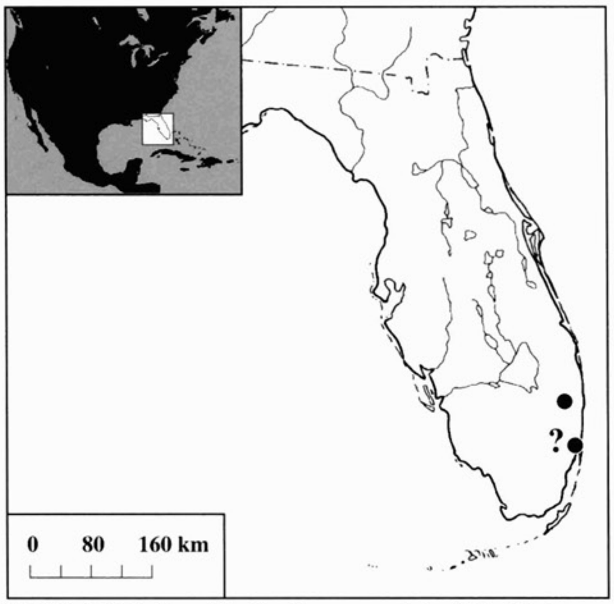


FIGURE 4. Adult male *Anolis c. chlorocyanus* (MCZ 57473) from 7 km N Carpintero, Provincia de San Juan, República Dominicana (from Williams 1965).



MAP 2. Distribution of *Anolis chlorocyanus* in the United States.

Males are bright green to brown, and often have two supra-axillary and lateronuchal tan spots and a pale lavender to tan postocular spot; spots are sometimes also present in females. Females are green or brown, typically with 2–4 tan longitudinal stripes, and a tan middorsal zone. No white markings are present on the head or neck. The axilla has vertical black and light bars or is unpatterned. The dewlap is small and, depending on the subspecies, can be blue and black, or black and yellow to tan, mustard, or dull ochre. Dewlap scales are white to blue.

• **DIAGNOSIS.** *Anolis chlorocyanus* can be distinguished from other Hispaniolan green anoles by the following combinations of characters: absence of white labial streak (from *A. coelestinus*), large dewlap scales (from *A. coelestinus, A. singularis,* and *A. aliniger*), black colored dewlap skin and white to blue dewlap scales (from *A. coelestinus*, *A. singularis*, *A. aliniger*, and *A. porcatus*), multicarinate supradigital scales (smooth in both *A. singularis* and *A. aliniger*), and non-prominent frontal ridges (from *A. porcatus*).

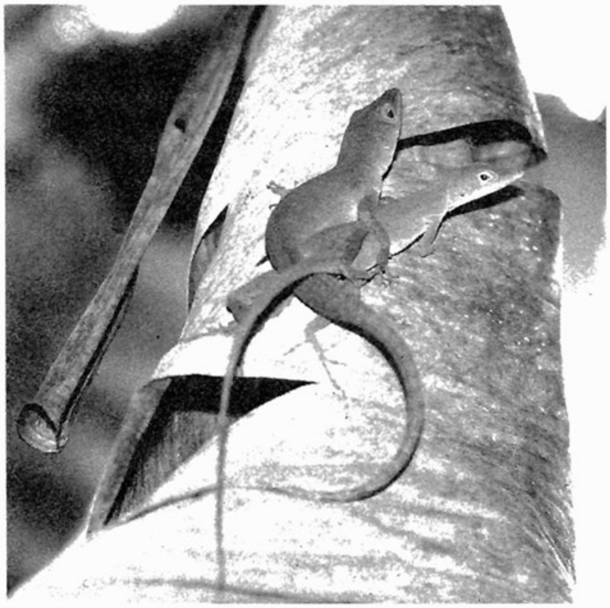


FIGURE 5. Mating *Anolis c. chlorocyanus* from Los Haitises, Provincia de Monte Plata, República Dominicana (photograph by Richard E. Glor).

• **DESCRIPTIONS.** In addition to the original descriptions by Duméril and Bibron (1837) and Mertens (1939b), detailed descriptions may be found in Cochran (1941), Williams (1965), and Schwartz and Henderson (1991). Gorman et al. (1967) described the karyotype (2N = 36) with 12 metacentric macrochromosomes and 24 microchromosomes, the latter "poorly resolved."

• **ILLUSTRATIONS.** Color photographs are in Bosch and Werning (1991), Fläschendräger and Wijffels (1996), and Bartlett and Bartlett (1999). Schwartz and Henderson (1985) included color drawings of males of both subspecies. Black and white photographs are in Mertens (1939b, 1940a,b), Schmidt and Inger (1957), Bels (1984a, 1992), and Glor et al. (2000). Line drawings were provided by Schmidt (1921, dorsal view of the head), Cochran (1941, dorsal and lateral views of the head, middorsal scales, side of the tail), Williams (1965, dorsal view of the head, axilla, dewlap scalation; 1969, dorsal view of the snout), Moermond (1978, color pattern), and Bels (1984a,b, display patterns and postures). Irish et al. (1988) included scanning electron micrographs of the epidermis, and Russell (1988) provided an illustration of bilateral fiber bundles of the *m. clavodeltoideus*.

• **DISTRIBUTION.** A Hispaniolan endemic, the species is found in a variety of mesic habitats throughout the main island and on several satellites (Gonâve, Tortue, Saona). Although native to the North Paleoisland, this species has subsequently invaded the "South Island" (Schwartz 1980; Powell et al. 1991, 1999), where it is sympatric with its South Island counterpart, *A. coelestinus*, in at least two locations (Williams 1965; Schwartz 1969, 1980; Powell et al. 1991; Garcia et al. 1994). The Hispaniolan range was previously illustrated in Williams (1965) and Schwartz and Henderson (1991).

Hoogmoed (1981) documented the release of specimens in Paramaribo, Surinam. This population may be extant, but more recent information is not available. In addition, escapees have established two colonies in Broward and Dade counties, Florida (Bartlett 1994, Bartlett and Bartlett 1999). Other Miami populations have apparently been extirpated. The Florida distribution was mapped in Bartlett and Bartlett (1999).

• **FOSSIL RECORD.** Etheridge (1965) reported a dentary assigned to *Anolis chlorocyanus* in a late Pleistocene deposit from near Pedro Santana, Provincia de Elias Piña, República Dominicana. de Queiroz et al. (1998) assigned a fossil anole in amber to the *A. chlorocyanus* group, but distinguished it from extant *A. chlorocyanus* by the number of subdigital lamellae.

• **PERTINENT LITERATURE.** References to *Anolis chlorocyanus* are arranged by topic: **behavior** (Mertens 1946; Garcea and Gorman 1968; Carpenter and Ferguson 1977; Milton and Jenssen 1979; Moermond 1981; Bels 1984a, b, 1986; Greene 1988; Powell and Parmerlee 1991; Gerber 1999), **comparative morphology** (general: Williams 1960, 1965; body size: Schoener 1969, 1970, 1988, Fitch 1981; dentary: Auffenberg 1956; dewlap: Rand and Williams 1970, Losos and Chu 1998; ear: Wever 1978; epidermal structure: Irish et al. 1988; pterygoid teeth: Williams and Rand 1969; subdigital lamellae: Glossip and Losos 1997), **ecomorphology** (Rand and Williams 1969, Peterson 1974, Williams 1983, Schoener 1988; Irschick et al. 1997, Losos and de Queiroz 1997, Beuttell and Losos 1999, Warheit et al. 1999), **genome** (Olmo 1984, 1986), **habitat** (Williams 1972, SEA/DVS 1990), **husbandry** (Bels 1983, Fläschendräger and Wijffels 1996), **hybridization with *A. coelestinus*** (Garcia et al. 1994; also see **Comment**), **interactions with introduced *A. porcatus*** (Powell et al. 1990, Roughgarden 1995, Henderson and Powell 2001), **longevity** (Snider and Bowler 1992), **natural history** (Rand 1962, Moermond 1983, Fitch et al. 1989, Powell and Parmerlee 1993, Bowersox et al. 1994, Glor and Flecker 1999), **parapatry with *A. coelestinus*** (Williams 1972), **parasites** (Telford 1975, lack of saurian malaria; Goldberg et al. 1996, helminths), **predation** (Henderson and Horn 1983, Henderson et al. 1987), **sampling methods** (Glor et al. 2000), **sexual size dimorphism and habitat** (Butler et al. 2000), **sympatry with *A. coelestinus*** (Williams 1965; Schwartz 1969, 1980; Powell et al. 1991), **systematics** (Etheridge 1960; Williams 1965, 1976; Gorman et al. 1971, Wyles and Gorman 1980; Burnell and Hedges 1990; Poe 1999), and **utility of l-lactate dehydrogenase gene expression in phylogenetic studies** (Murphy 1999).

This species is included in **guides, checklists, and notes** (some of which may include brief descriptions) by Duméril (1851), Reinhardt and Lütken (1862), O'Shaughnessy (1875), Garman (1887 [1888]), Fischer (1888), Müller (1892), Boettger (1893), Meerwarth (1901), Barbour (1914, 1930, 1935, 1937), Cochran (1924, 1928, 1934), Mertens (1938, 1939a, 1940a,b), Böker (1939), Grant (1956), Williams and Rand (1969), Schwartz and Thomas (1975), MacLean et al. (1977), Schwartz (1977), Williams (1977), Henderson and Schwartz (1984), Henderson et al. (1984), Obst et al. (1984), Schwartz and Henderson (1985, 1988), Wetherbee (1988), Cusumano et al. (1991), SEA/DVS (1992a,b,c), Bartlett (1994), Butterfield et al. (1994), O'Hare and Williams (1994, see also Williams et al. 1995), Frank and Ramus (1995), Fläschendräger and Wijffels (1996), Irschick and Losos (1996), Powell (1999), and Powell et al. (1996, 1998, 1999).

• **REMARKS.** In the original description, Duméril and Bibron (1837) provided a synonymy that included references to animals that were clearly not *Anolis chlorocyanus*. Some of the confusion might be attributable to uncertainty regarding the distribution of the species (note the erroneous inclusion of Martinique in the type locality).

O'Shaughnessy (1875) mistakenly included *Anolis coelestinus* Cope in the synonymy of *A. chlorocyanus*.

• **ETYMOLOGY.** The name *chlorocyanus* is derived from the Greek *chloros*, meaning green, and *kyanos*, meaning blue,

obviously in reference to the coloration of this lizard in life. The name *cyanostictus* is derived from the Greek *kyanos* and *stiktos*, meaning spotted or dappled, in allusion to the dorsal pattern in this form.

• **COMMENT.** In the area of hybridization with *Anolis coelestinus* in Barahona, República Dominicana, males and females of both species responded with equal alacrity to the proximity of members of either species. Also, despite expectations that character displacement should enhance differences in display patterns, distinctions noted by Garcea and Gorman (1968) were, if anything, less obvious than was indicated in their preliminary study (R. Garcia, unpubl. data).

1. *Anolis chlorocyanus chlorocyanus* Duméril and Bibron

Lacerta bullaris Linnaeus 1758:308. See species synonymy.
Anolius bullaris: Gray 1845:206. See species synonymy.
Anolis bullaris: Daudin 1802:69 (part). See species synonymy.
Anolis chloro-cyanus Duméril and Bibron 1837:117. See species synonymy.
Dactyloa (*Xiphosaurus*) *chlorocyanus*: Fitzinger 1843:67. See species synonymy.
Anolis læviceps Lichtenstein 1856:7. See species synonymy.
Anolis chlorocyanus: Müller 1892:211. See species synonymy.
Anolis chloro-cyanus chloro-cyanus: Mertens 1939b:62. First use of trinomial.
Anolis chloro-cyanus peynadoi Mertens 1939b:65. Type locality, "Südlich von Fondo Negro, untererer Rio Yaque del Sur" (= south of Fondo Negro, lower Rîo Yaque del Sur, [Provincia de Barahona, República Dominicana]). Holotype, Natur-Museum Senckenberg, Frankfurt-am-Main (SMF) 26201, adult male, collected by R. Mertens, 13 April 1939 (not examined by authors).

• **DIAGNOSIS.** This subspecies is defined (Mertens 1939b) by the following combination of characters (N = 47): males usually without any indication of pattern, females with distinct longitudinal stripes, and dewlap with white scales, light grayish blue skin, and a large blue-black basal spot.

2. *Anolis chlorocyanus cyanostictus* Mertens

Anolis chloro-cyanus cyanostictus Mertens 1939b:64. Type locality, "zwischen Fortaleza und der Mündung des Rio Jaina" (= between Fortaleza and the mouth of the Río Haina, [Distrito Nacional, República Dominicana]). Holotype, Natur-Museum Senckenberg, Frankfurt-am-Main (SMF) 26290, adult male, collected by R. Mertens, 28 March 1939 (not examined by authors).

• **DIAGNOSIS.** This subspecies is defined (Mertens 1939b) by the following combination of characters (N = 19): males and females usually with brown postocular and scapular spots, large males in green phase with bright blue circumorbital rings and similarly colored flecks on the sides of the head and neck, large females often without distinguishable longitudinal stripes, and dewlap with white scales, green to light blue skin, and yellowish green to bright yellow basal spot.

• **ACKNOWLEDGEMENTS.** Kraig Adler and Robert W. Henderson were of invaluable assistance in finding pertinent references.

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YANERYS M. RAMOS, Department of Biology, Cornell University, Ithaca, NY 14853, USA (ymr1@cornell.edu), and **ROBERT POWELL**, Department of Biology, Avila College, Kansas City, MO 64145, USA (powellr@mail.avila.edu).

Primary editor for this account, Andrew H. Price.